Spread of hoax in Social Media

A report on empirical case

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Abstract

We discuss the way of hoax spreading as gossip and rumor throughout the social media, *i.e.:* Twitter, by observing an empirical case in Indonesia. We discuss the spreading factor of the gossip in the social media and see the epidemiology of the propagation hoax before and after the hoax being clarified in the conventional mass media. The discussions brought us to the open enrchiment analysis of the sociology of gossip and rumors within the online services like Twitter for future observation of human behavior.

Keywords: social media, gossip, rumor, hoax, Twitter.

There are a terrible lot of lies going about the world,
and the worst of it is that half of them are true.
Winston Churchill

1. Introduction

To gossip is human socially. Gossips and rumors have been a sort of "fun" way to exploit the existing asymmetric information in social life. It has been even recognized as an important thing in the sustainability and adaptability in social groups throughout the long run of human evolution [1, 12]. Recent modern life has brought us a great deal places for gossips and rumors in the name of information exchange. The role of social media, micro-blogging, social network services have played a very important role in the way we gossip. Yet, this customer-driven media are prone to hoax, lies, as information flows from person to person unstoppably. There have been a lot of cases worldwide how hoaxes spread by riding gossips and rumors throughout social media, the hoax of the death of human rights figure, Nelson Mandela (January, 2011), rock star Mick Jagger (February, 2011), and the martial-art movie actor, Jackie Chan (March, 2011). In the period of the paper is written, the three world figures are alive in good conditions, yet the rumors on their death have hit the world's twitter trending topics. Recently, in Indonesia some similar thing has also been occurred[*]. This is the ground on which the discussion of the paper is established upon.

Gossips and rumors spread upon social network within the social interaction and communications. In some cases, the spreading of gossips and rumors could be seen like an "information epidemiology" diffusing like a disease contiguously from people to people and places to places over time [9]. In fact, understanding rumors and gossips could give us more insights on the "herding behavior" in market [10], and even the issue related to social influence [2], beliefs [7], and political extremism [3]. There have been some studies on the spreading of gossips and rumors within social network. Most of them have been focused on the topological landscape in which the gossips and rumors are being smeared [6}. It has been understood that human behavior on gossips and rumors affects the structure of the social network [8]. However, the paper discusses the spreading of gossips and rumors upon Twitter, a wide online micro-blogging services [4].

2. Twitter as Media for Gossips and Rumors

As Twitter has unique community structure [11], the way a rumor or gossip spreads through it has also some practical differences with those does mouth to mouth of conventional social network [5]. Since it is an online service, the diffusion of news is interestingly much fasters spatially and chronologically. A gossip about a public figure in Indonesia reached about more than 50,000 readers as tweeted by 59 social actors within many different cities only for about two hours before it has been recognized to be a hoax.

In our case of study, someone who does not necessarily have thousands of twitter followers posted a question about whether a public figure has been dead, and within minutes it has become a statement for sympathy and condolences form thousands of people. The showcase has shown that a rumor about a particular public figure does not have to come from other public figures in order to be propagated so vastly in twitter. Definitely, this is a nature why we call Twitter service as social media.

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[*] For about two hours in May 2nd 2011, the hoax of the death of Yohanes Surya, a notable figure of physical sciences, was circulated in Twitter nationally. It was later recognized that the news has been confused to the death of the Indonesian Pelita Harapan University figure, Johanes Oentoro. However, a nationa media has revealed this as hoax and the rumors were declined in the conventional mass-media. URL:
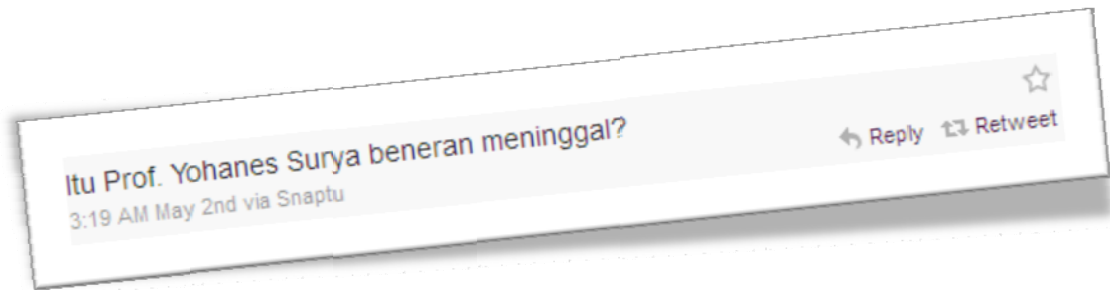`http://www.mediaindonesia.com/read/2011/05/05/222764/293/14/Yohanes-Surya-Saya-Sehat-Walafiat`

Figure 1
The detected patient zero of the gossip, saying "…is it true that *xxxxxxx* died?"

 "Patient zero" posted a question at $t=0$ and introduced by almost 300 his followers. Within minutes, some "Twitter celebrities" (regarded to be ones with thousands of followers) posts quite different questions and thus, it has been propagated as sympathetic tweets for condolences. However, after more than an hour, a national media interviewed the corresponding figure and the propagation was cut off. The spreading of the hoax is shown as graph in figure 2. Here, the nodes are depicted regarding to the number of followers of the respective people. The arrows are shown the direction of the propagation, be it as a mention or edited retweet. The dotted lines denote that the agents do not necessarily to be following-followers in Twitter yet showing the timely propagation.
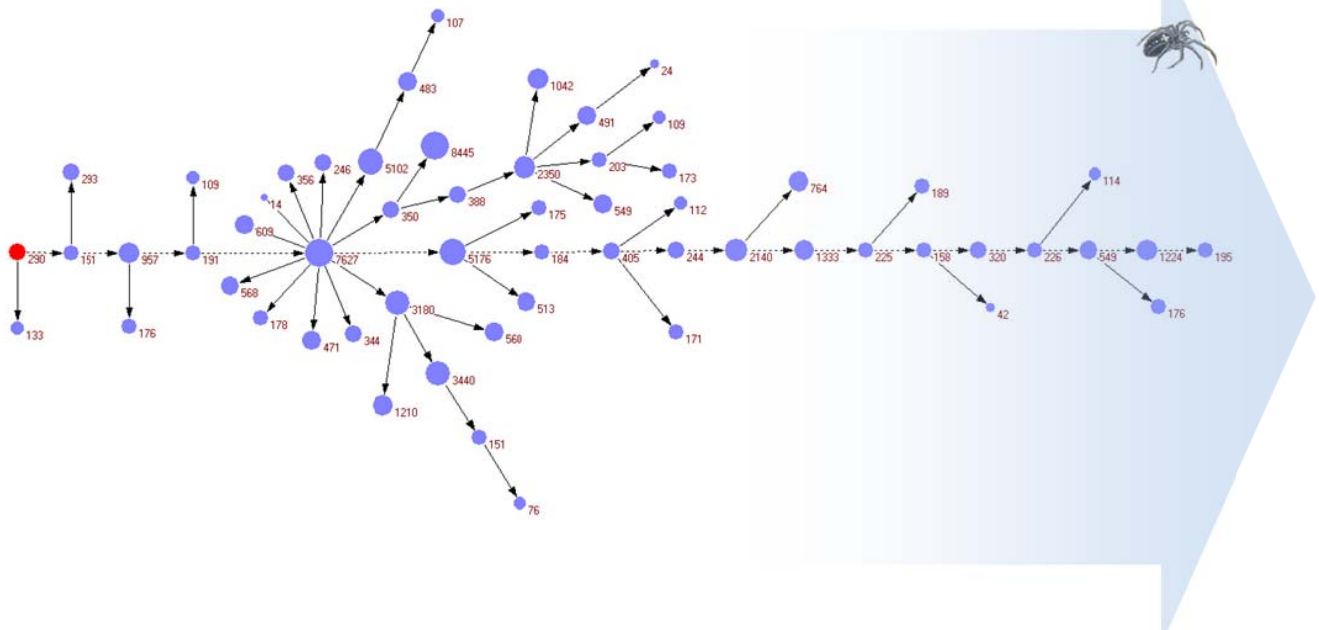

Figure 2
An empirical spreading of a gossip via Twitter (the nodes are labeled and sized by the number of followers of the agent and the blue arrow shows as the gossip has been recognized as hoax)

What is shown in figure 2 is not the propagating of the hoax, but the communications in which the hoax was smeared. Every nodes are representing the Twitter accounts with respective number of followers. In twitter, any posts are readable by the corresponding followers and here is the thing that made the hoax are propagated so fast from people to people. A fact, that a national media covered the issue by showing that it was definitely a hoax.

3. The epidemiology of the hoax

When it comes to the influence of the tweets regarding to this issue, we can calculate how far it has reached by, showing an agent i's post as retweeted by agent j

$$N = \sum_t \sum_{ij} F_i(t) + F(t)_j - F_{ij}(t) \tag{1}$$

where $F_{ij}(t)$ is the numbers of followers shared by the both agents over time the round of the tweets t. And here we can have the figure 3 depicting the impact of any tweets mentioning the hoax.
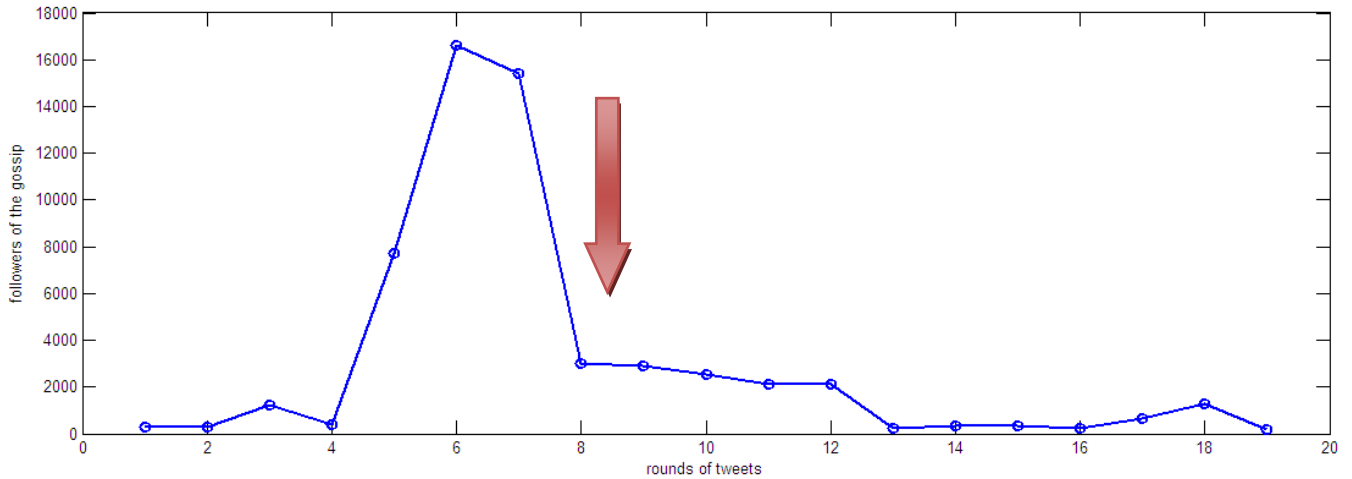

Figure 3
The followers of the gossip over the two hours the gossip spread throughout the social media. The red arrows shows the time the cover of the national media regarding to the hoax.

It is apparent that the numbers of the followers of the issue were raised and by the time the media covered, the numbers of the followers were damped and diminished abruptly. It is also worth to note that we collect the tweets after the information is clear that it was actually a hoax. It seemed that some tweets were deleted by the users after the national media demonstrated that it was really a hoax. It is understandable that some "twitter celebrities" have moral obligation not to get along with a fake news, as to the weighing that the issue was extremely sensitive for it was all about the life of a notable public figure.

As noted in [5], we can measure the effectiveness of the propagated gossip by a simple spreading factor of,

$$f = \frac{N}{k} \tag{2}$$

where n_f is the number of people who eventually recognize the gossip, and k is the degree to the victim. In our cases, since the victim a well known public figure, it can be simply understand that $k \approx 1$, thus the spreading factor is proportional to the number of people eventually know the gossip. Thus, the spreading time over rounds of tweets, τ, can be written as the function of the spreading of the rumors via tweets,

$$\tau = A + B \log N \qquad\qquad\qquad\qquad (3)$$

Obviously, this demonstrated the hypothetical view on how the spreading of gossips and rumors within the social network follows the exponential growth of population,

$$N = \exp\left(\frac{\tau - A}{B}\right) \qquad\qquad\qquad\qquad (4)$$
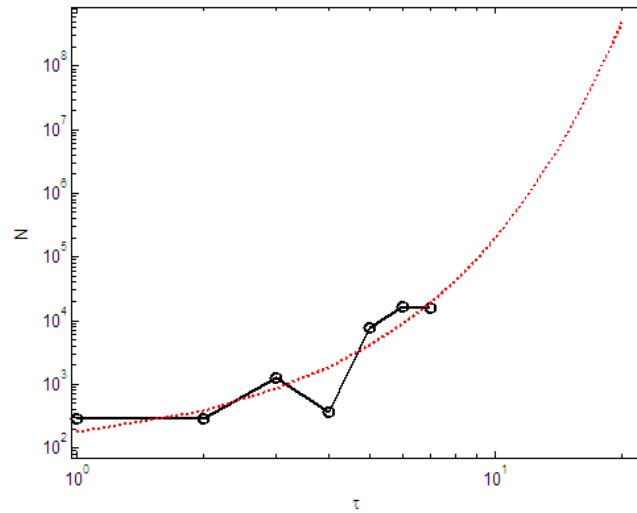
as shown in figure 4.

Figure 4
The growing numbers of the people knows a hoax in Twitter and the exponential (dashed line) extrapolation

The growing population within the spreading of gossip and rumors shows the coefficient $A = -5.6308$ and $B = 1.28$ with $R = 0.90068$. This has similarities with the findings of the experiment within the Alber-Barabasi scale free network [4], demonstrating $A = -10.77$ and $B = 2.433$. Hypothetically we can extrapolate the possible spreading rumors otherwise the media did not cover the spreading news as a hoax.

It is also interesting to see the ranking plot of the followers of the agents spreading the hoax that is fitted with the power law, the one that reflects the structure of the landscape of the propagation. Despite the wide space of the propagation, obviously only small amount of agents has thousands of followers as shown in figure 5. The number of the followers of the agents follows,

$$r(n) \sim n^{-\alpha} \qquad\qquad\qquad\qquad (5)$$

where n is the rank of the descending followers agents and α denotes the exponent of the power law.The calculation demonstrates that the exponent $\alpha = 1.3863$, a value that somehow, can be related to the graph topology of the Twitter as discussed in [11].

Twitter has been a social media that collaboratively make it possible creating 'collective reality' from hoaxes. The exponential reaching points have somehow become an alternative to the conventional

media. Yet, the regime is still on the side of the ruling mass media that still give reliable news for the community. This has been shows by the damped of the hoaxes as shown in figure 3.
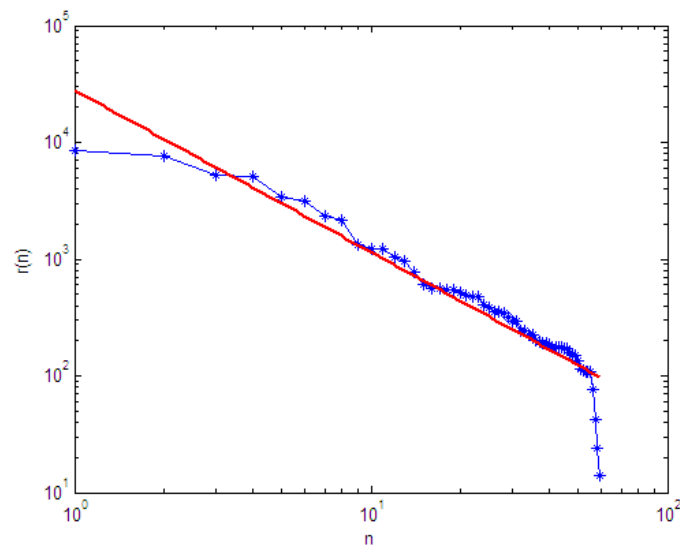

Figure 5
The rank of followers of the agents in our case of study

4. Closing Remarks

Information technology has given modern people tools for spreading gossips and rumors. Twitter, as a micro-blogging service is one of the tool effectively spreading news from person to person in the speed that is comparable with the conventional mass media. Our exposure to a hoax that is smeared among Indonesian Twitter users demonstrated this fact. Thus, the future sociology of gossips and rumors will put the online services like Twitter into account for further understanding the way human beings evolve.

Twitter has become a collaborative network of spreading information. The original source (or the "patient zero") does not necessarily one with huge amount of followers; the collaboration makes the information become huge. The hoax that has become the case of study in the paper has shown to have large population scope in five to six steps of tweeting, and potentially larger exponentially unless a conventional media stopped the spreading of the hoax.

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